

REMARKS/ARGUMENTS

Claims 16-44 are pending in the present application. By this Amendment, claims 17, 18, 29, 32, 33, 43, and 44 are canceled and claims 16, 19, 22, 24, 27, 30, 34, 35, 37 and 42 are amended. In addition, the specification is amended to correct an obvious error. No new matter is added.

Specifically, on page 15, paragraph [0085] the word “irregularly” is replaced with the word “regularly.” The word irregularly was erroneously used to describe the way the liquid crystal molecules are arranged when a voltage is applied to the liquid crystal. This is an obvious error, as is evident by the fact that it is inconsistent with other references to this effect in the specification. For example, see page 15, paragraph [0088] which states: “If the voltage is not applied to the liquid crystal 26 having the hologram pattern of the corresponding pixels, the liquid crystal molecules 26 are arranged irregularly.” (Emphasis added). See also page 13, paragraph [0075] which states: “If the voltage is not applied to the hologram pattern of the liquid crystal, the liquid crystal molecules 42 are arranged irregularly...” (Emphasis added). See also page 14, paragraphs [0077] and [0078] which state: “...if the voltage is applied to the hologram pattern liquid crystal, the incident light 60 permeates the hologram pattern liquid crystal. This is because the liquid crystal molecules 42 are arranged in the same direction by the applied voltage.” (Emphasis added).

An amendment to correct an obvious error does not constitute new matter where one skilled in the art would not only recognize the existence of the error in the specification but also the appropriate correction. *In re Oda*, 443 F.2d 1200, 170 USPQ 268 (CCPA 1971). Applicant respectfully submits that the amendment to the specification is one to correct an obvious error, as evidenced by the passages from the specification cited above. Applicant respectfully submits that one skilled in the art would have recognized the existence of this error, and that the appropriate correction would be to replace the word “irregularly” with the word “regularly.” Accordingly, no new matter is added.

The Patent Office objects to the drawings under 37 C.F.R. 1.83(a). Specifically, the Patent Office claims that “a plurality of cladding layers and respective core layers” recited in claim 43 and “the plurality of core layers are arranged substantially parallel to the first or second set of electrodes” recited in claims 29 and 44 are not shown in the drawings. Claims 29, 43 and 44 have been canceled, and thus this objection is now moot.

Claims 16-44 are rejected under 35 U.S.C. § 112, first paragraph as based on a disclosure which is not enabling. This rejection is respectfully traversed.

The Patent Office alleges that the “*conditions* of having the refractive index of the liquid crystal holographic optical element to be **greater** than the refractive index of the waveguide **and** the light incident on the liquid crystal holographic optical element must be *greater* than a *critical angle* in order for the light to be reflected back to the optical waveguide *via total internal reflection*

are critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure.” (Emphasis in original). Thus, the Patent Office concludes that claims 16-44 are not enabled by the disclosure.

Claims 16 and 30 now recite that the liquid crystal holographic optical element comprises at least one hologram that is selectively adjustable, based on a voltage applied across the crystal liquid holographic optical element by the first and second set of electrodes, between a first state, in which a refractive index of the holographic optical element is such that substantially all of the input light is reflected back to the optical waveguide via total internal reflection and at least one other state, in which the refractive index of the holographic optical element is such that at least some of the input light is transmitted through the liquid crystal holographic optical element. Applicant respectfully submits that all critical features in the specification are now recited in claims 16 and 30.

Specifically, claims 16 and 30 now explicitly state that the first and second states of the liquid crystal holographic optical element are linked to the refractive index of the holographic optical element. Further, claims 16 and 30 explicitly state that the refractive index is such that either substantially all of the input light is reflected back to the optical waveguide via total internal reflection or such that at least some of the input light is transmitted through the liquid crystal holographic optical element.

Applicant respectfully submits that this language sufficiently claims the critical feature of controlling whether light goes through the holographic optical element or is reflected back to the optical waveguide via total internal reflection. Once the critical feature is identified, Applicant respectfully submits that it is not necessary to claim the inherent physical laws that govern how total internal reflection in the optical waveguide takes place. For example, claims 16 and 30 recite that there is a state of the liquid crystal holographic optical element in which the refractive index of the liquid crystal holographic optical element is such that total internal reflection takes place. It is an inherent requirement that the light incident on the liquid crystal holographic optical element have an angle of incidence greater than the critical angle for the light to be reflected back to the optical waveguide via total internal reflection.

This is analogous to a claim which recites a mirror that receives light from a first component and reflects the light to a second component. A "necessary criterion" for this to occur is that the light from the first component first has to hit the mirror, and the mirror must have the proper angle relative to the propagation direction of the light to properly reflect the light to the second component. However, these "necessary criteria" do not have to be explicitly recited in the claim. Someone of ordinary skill in the art would recognize that the mirror must be properly placed and its angle properly adjusted to reflect light from the first component to the second component. Similarly, Applicant respectfully submits that someone of ordinary skill in the art would recognize that light inside a waveguide must strike the liquid

crystal holographic optical element at an angle greater than the critical angle in order for the claimed "total internal reflection" to take place.

The Patent Office further alleges that the claims fail to provide how the hologram of the liquid crystal holographic optical element is switched or is "selectively adjustable" in order for the light to be reflected back to the optical waveguide via total internal reflection. As discussed above, claims 16 and 30 recite that the liquid crystal holographic optical element comprises at least one hologram that is selectively adjustable, based on a voltage applied across a liquid crystal holographic optical element, between a first state, in which a refractive index of the liquid crystal holographic optical element is such that substantially all of the input light is reflected back to the optical waveguide via total internal reflection, and at least one other state, in which the refractive index of the liquid crystal holographic optical element is such that at least some of the input light is transmitted to the liquid crystal holographic optical element. Thus, Applicant respectfully submits that the claims clearly recite that the hologram in the liquid crystal holographic optical element is adjusted with a voltage that is applied across the liquid crystal holographic optical element. Further, the claims clearly recite that, in one state, the refractive index of the liquid crystal holographic optical element is such that substantially all of the input light is reflected back to the optical waveguide via total internal reflection.

The Patent Office further alleges that the claims also fail to teach how the hologram is adjusted to have at least some of the input light be transmitted through the liquid crystal

holographic optical element. Applicant respectfully submits that the claims do not have to teach how the hologram performs its function. It is the specification as a whole that needs to enable the claims. The claims properly recite the feature that at least some of the input light is transmitted through the liquid crystal holographic optical element in the second state of the hologram. The specification, at page 16, paragraphs 92-97 provides sufficient teaching to one of ordinary skill in the art as to how to implement this claimed feature.

Claims 17, 18, 29, 32, 33, 43 and 44 are canceled, and thus their rejection is now moot. Claims 19-28 depend from claim 16, and claims 31 and 34-42 depend from claim 30. Thus, for at least the reasons set forth above, Applicant respectfully submits that the claims are properly enabled. Accordingly, withdrawal of the rejection under 35 U.S.C. §112, first paragraph, is respectfully requested.

The Patent Office rejects claims 22 and 37 under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. This rejection is respectfully traversed.

The Patent Office alleges that the specification and the claims fail to teach how a hologram is capable of being adapted to diffract red, green and blue light. The Patent Office points out that a single hologram can only diffract one particular wavelength of the light due to the nature of the hologram. Claims 22 and 37 now recite that the liquid crystal holographic optical element comprises first, second and third holograms in each of the red, green and blue sub-pixel areas that are adapted to diffract red, green and blue light, respectively. Thus, the

claims recite a separate hologram for diffracting each of the red, green and blue light components. Thus, Applicant respectfully submits that claims 22 and 37 comply with the enablement requirement. Accordingly, withdrawal of the rejection under 35 U.S.C. §112, first paragraph, is respectfully requested.

The Patent Office objects to claims 17, 19-22, 24, 27-28, 31, 32, 34-37 and 42-44 because of various informalities.

The Patent Office alleges that the phrases "pixel areas" and "sub-pixel areas" recited in claims 17, 19, 32 and 34 are confusing and indefinite because it is not clear what is considered to be the pixel and sub-pixel areas and, in particular, that it is not clear how pixel and sub-pixel areas relate to the liquid crystal holographic optical element. Claims 17 and 32 have been canceled, and thus their objection is now moot. With regards to claims 19 and 34, Applicant refers the Examiner to page 11, paragraphs 58-59, and page 17, paragraphs 99-103, which describe how a pixel can be divided into three sub-pixels in order to implement a color image. Further, Applicant respectfully submits that the term "pixel" and "sub-pixel" are very common and well known terms in the display arts. The use of red, green and blue sub-pixels is a very common way of implementing a full color pixel.

The Patent Office alleges that the phrase "the first set of electrodes" recited in claim 16, "the first and second set of electrodes" recited in claims 17 and 18 and the phrase "the first and second set of electrodes" recited in claims 29 and 43 are confusing and indefinite because they

lack proper antecedent basis. Claims 17, 18, 29 and 43 have been canceled, and thus their objection is now moot. Claim 16 has been amended to provide proper antecedent basis.

The Patent Office alleges that the phrase "through the selected area if the liquid crystal holographic optical element" in claim 24 is "totally confusing." Claim 24 has been amended to correct the obvious typographical error.

The Patent Office alleges that "an area that is substantially the same as an effective display area" recited in claims 27 and 42 is confusing and indefinite because the phrase "effective display area" is allegedly not defined. Claims 27 and 42 now recite that the core layer has an area that is substantially the same as an effective display area of the display device. One of ordinary skill in the art would recognize that any given display would display an image over a predetermined active area of the display device. It is this "effective display area" that is recited in claims 27 and 42.

The Patent Office alleges that the phrase "a plurality of light guiding cores" recited in claims 28 and 42, and the phrase "the plurality of light guiding cores are arranged substantially parallel to the first or second set of the electrodes" recited in claims 29 and 43 are confusing and indefinite because it is not clear how these phrases relate to the liquid crystal holographic optical element. Claims 29 and 43 have been canceled and thus their objection is now moot. With regards to claim 28, claim 16, from which claim 28 depends, recites an optical waveguide, comprising at least one light guiding core. Further, claim 16 recites a first set of electrodes

positioned on the at least one light guiding core and a liquid crystal holographic optical element positioned on the first set of electrodes. Thus, claim 16 clearly recites how these elements relate to one another. Further, claim 28 simply recites that the optical waveguide comprises a plurality of light guiding cores. On the plurality of light guiding cores, a first set of electrodes is positioned, and a liquid crystal holographic optical element is positioned on the first set of electrodes. Thus, it is clear how these elements relate to one another. Applicant also refers the Examiner to Figures 5 and 6, and the associated discussion in the specification on page 10, paragraphs 51-54, which clearly explain how these elements relate to each other, and how the plurality of light guiding cores are arranged substantially parallel to the first or second set of electrodes.

The Patent Office alleges that the phrase "an index of refraction of the liquid crystal holographic optical element in the first state is substantially the same as the index of refraction of the at least one cladding layer" recited in claim 31 is confusing and indefinite because it is not clear how this feature has anything to do with the device. Applicant refers the Examiner to page 15, paragraph 84 to page 16, paragraph 90 of the specification which explains how one state of the hologram pattern (obtained when a voltage is applied to the liquid crystal 26), the liquid crystal molecules of the liquid crystal 26 are arranged to have a constant refractive index, which is the same as the refractive index of the cladding 23. Because the refractive index of the liquid crystal molecules of the liquid crystal 26 is the same as that of the cladding 23, the liquid crystal

molecules of the liquid crystal 26 will also function in a manner similar to the cladding 23, i.e., it will totally internally reflect light back to the core of the optical waveguide. Accordingly, Applicant respectfully submits that claim 31, when properly read in view of the specification, recites a feature that is clearly related to the functioning of the device.

Accordingly, for at least the reasons set forth above, withdrawal of the objection to claims 17, 19-22, 24, 27-28, 31, 32, 34-37 and 42-44 is respectfully requested.

The Patent Office rejects claims 16-20 and 24-27 under 35 U.S.C. §102(e) as anticipated by U.S. Patent No. 6,821,457 to Natarajan et al. (hereafter "Natarajan"). This rejection is respectfully traversed.

Natarajan fails to disclose every claimed feature, as required under §102. Natarajan discloses an electrically switchable liquid crystal material and optical couplers and reconfigurable optical interconnects using the electrically switchable liquid crystal materials. Claim 16 recites a display device that comprises first and second sets of electrodes that define pixel areas of the display device and are adapted to selectively apply voltage across one or pixel areas of the liquid crystal holographic optical element. Natarajan does not teach or suggest these features as Natarajan is directed at switchable optical couplers and reconfigurable optical interconnects.

Thus, Applicant respectfully submits that Natarajan fails to anticipate the subject matter of claim 16. Claims 17 and 18 are canceled, and thus their rejection is now moot. Claims 19, 20 and 24-27 depend from claim 16. Thus, these claims are allowable for at least the reasons

discussed above, as well as for the additional features they recite. For example, claim 19 recites that the first and second sets of electrodes further define sub-pixel areas. As discussed above, Natarajan is directed at optical couplers and reconfigurable optical interconnects, and thus does not teach or suggest a display device, much less a display device with sub-pixel areas. The Patent Office alleges that each of the holographic optical elements in Figure 26 of Natarajan "can be identified" as the sub-pixel and that a set of sub-pixels "can be identified" as the pixels.

Applicant respectfully submits that the test of whether a claim is anticipated under 35 U.S.C. §102 is not whether something in the prior art reference "can be identified" by the Examiner as an element in the claim, but rather whether every element in the claim is actually taught by the prior art reference. Natarajan "identifies" the device of Fig. 26 as a "reconfigurable interconnect incorporating switchable HOEs." (See col. 19, lines 35-37). There is no teaching or suggestion of a display device with pixels and sub-pixels. Accordingly, withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

The Patent Office rejects claims 30-44 under 35 U.S.C. §103(a) as unpatentable over Natarajan in view of U.S. Patent No. 5,518,863 to Pawluczyk. This rejection is respectfully traversed.

Claim 30 recites, *inter alia*, a display device that comprises first and second sets of electrodes that together define pixel areas of the display device and that are adapted to selectively apply a voltage across one or more pixel areas of the liquid crystal holographic optical element.

As discussed above, Natarajan fails to teach or suggest these features because Natarajan is not directed to a display device, but rather to optical couplers and reconfigurable optical interconnects. Further, Pawluczyk fails to remedy the deficiencies noted above in Natarajan.

Thus, for at least the reasons set forth above, Applicant respectfully submits that Natarajan and Pawluczyk fail to render obvious the subject matter of claim 30. Claims 32, 33, 43 and 44 have been canceled. Claims 31 and 34-42 depend from claim 30, and are thus also allowable for at least the reasons set forth above, as well as for the additional features they recite. Accordingly, withdrawal of the rejection under 35 U.S.C. §103(a) is respectfully requested.

CONCLUSION

In view of the foregoing amendments and remarks, it is respectfully submitted that this application is in condition for allowance. Favorable consideration and prompt allowance are earnestly solicited. If the Examiner believes that any additional changes would place the application in better condition for allowance, the Examiner is invited to contact the undersigned attorney, René A. Vázquez, Esq., at the telephone number listed below.

Serial No. **10/662,316**
Reply to Office Action of **March 29, 2005**

Docket No. **K-0541**

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this, concurrent and future replies, including extension of time fees, to Deposit Account 16-0607 and please credit any excess fees to such deposit account.

Respectfully submitted,
FLESHNER & KIM, LLP



René A. Vázquez, Esq.
Registration No. 38,647

P.O. Box 221200
Chantilly, Virginia 20153-1200
(703) 766-3701 DYK/RAV:knv:jld:knv
Date: SEPTEMBER 28, 2005

Please direct all correspondence to Customer Number 34610

\\fk4\Documents\2016\2016-648\75496.doc